DOCUMENT RESUME

ED 164 881 CE 019 077

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TITLE Career Development Programs. Metals Program Management System.
INSTITUTION Santa Clara County Office of Education, San Jose, Calif.
PUB DATE 76
NOTE 40p.; For related documents see CE 017 075-076

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Behavioral Objectives; Course Organization; Curriculum Guides; Decision Making; *Management Systems; *Metals; Metal Working Occupations; *Performance Based Education; *Performance Criteria; Secondary Education; Skill Development; *Student Evaluation; Task Performance; Trade and Industrial Education

ABSTRACT

This curriculum guide describes a broad range of teaching objectives and student learning experiences in several metal occupations. It also provides assistance to students in gathering data for personal decision making with regard to the metals industry as a career alternative and helps prepare students for entrance into post-high school technical programs. Specific units cover entry-level skills development in the areas of safety, metals technology, bench and wrought metal, sheet metal, art metal, forging, heat treating, foundry, welding, machine shop, metals in everyday living, and finishing. The guide is also designed to assist the local teacher with organization and management of the course. It describes the accountability line and the information flow from the teacher to the principal and to the superintendent. The management system includes measurable objectives which detail the responsibilities of the teacher and the students. The student performance objectives are arranged in nine-week time frames to facilitate the collection of evaluation data at the same time as quarterly grades are issued. The appendix contains a management system report, time frame checklists for teacher and student objectives, and a narrative report example with instructions. Two other curriculum guides accompany this document and include performance objectives for courses in health occupations education (CE 019 076) and industrial arts (CE 019 075). (CT)

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CAREER DEVELOPMENT

PROGRAMS

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METALS PROGRAM

MANAGEMENT SYSTEM

CE 019 077

San Mateo Union High School District
San Mateo, California
1976

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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METALS PROGRAM

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METALS PROGRAM

INTRODUCTION

Man has been using metal for approximately 5,000 years. Found in the form of meteorites, he first regarded it as a precious gift from heaven, and worked it into jewelry, charms, and amulets. These he wore as a matter of personal pride, and to ward off evil spirits.

About 2,500 years ago, man learned to make crude iron over open campfires. He soon put this new discovery to use in the making of weapons to maintain his control over the animal kingdom, and later to fashion the tools which were to raise his standard of living and place him in a higher type of civilization.

Some 100 years ago, the development of large-scale manufacture made iron and steel the cheapest metallic materials on earth, and making things of metal is now the biggest industry in the United States. More people are employed and more products in money value are produced than in any other industrial field. The chances are more than one in ten that a student will someday be employed in some phase of the metalworking industry.

Teachers, Metals Program

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METALS PROGRAM

PROGRAM DESCRIPTION

The Metals Program is designed to provide a broad range of student learning experiences in several metals occupations. Specific units cover entry-level skills development in the areas of bench and wrought metal, sheet metal, art metal, forging, heat treating, foundry, welding, and machine shop. The over-all program is geared to lead the student into post high school employment or to advanced training.

The program will be in operation at each high school in the district for a minimum of one hour a day, five days a week, and will cover a time span of three school years. The minimum of one hour a day is to be devoted to classroom/lab learning activities, with the possibility that some advanced students may spend an additional ten hours a week in on-the-job training in a metals industry.

An Industrial Arts Advisory Committee, composed of leaders of local industry, will be utilized to validate and update the instructional program, to assist with the related instruction, and in making work experience placements.

Students will be encouraged to utilize the services of the on-site career center for additional opportunities to explore career alternatives in the metals industry.

Special efforts will be made to recruit, train, support, and place disadvantaged, handicapped, and minority students in entry-level metals occupations.

METALS PROGRAM

PROGRAM GOALS AND EXPECTANCIES

Metals Program Goals

The primary goals of the Metals Program are to:

- Acquaint students with the broad range of career alternatives available in the metals industry
- Acquaint students with the different methods of metal fabrication
- Assist students in gathering data for personal decision making with regard to the metals industry as a career alternative
- Provide students with entry-level skills
- Prepare students for entrance into post-high school technical programs

District Goals and Expectancies

The Metals Program assists students to achieve the following district educational goals and expectancies:

1.0 Know the many forms in which communication occurs and communicate effectively

Expectancies: 1.1, 1.3, 1.4, 1.5, 1.7, 1.8, 1.13

2.0 Maintain good physical and mental health

Expectanices: 2.3, 2.5, 2.6, 2.7

3.0 Understand and accept themselves and others

Expectancies: 3.2, 3.10, 3.11, 2.12

4.0 Be aware of and sensitive to value systems

Expectancies: 4.5, 4.6

5.0 Participate in the economic, political and social aspects of modern organized society

Expectancies: 5.2, 5.7

METALS PROGRAM

PROGRAM GOALS AND EXPECTANCIES (Cont'd)

District Goals and Expectancies

6.0 Apply the process of problem solving

Expectancies: 6.7, 6.10

7.0 Have a comprehensive knowledge of the world of work

Expectancies: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11

8.0 Realize the role of education in human progress

Expectancies: 8.3, 8.4, 8.6

9.0 Conserve the natural and human resources of their environment

Expectancies: 9.2, 9.3, 9.4

10.0 Use leisure time in individually and socially productive ways

Expectancies: 10.3, 10.4

METALS PROGRAM

TEACHER FACILITATING OBJECTIVES

The teacher facilitating objectives are designed to provide a performance framework that defines the teacher's tasks in the management of the Metals Program and in assisting students to reach the objectives of the program. He/she will:

1. Provide orientation sessions for students enrolled in metals classes

   Evaluation--Complete by the end of first week

2. Conduct a safety test of each student on general shop safety

   Evaluation--Complete by the end of second week

3. Provide students with assistance in unit planning and completion of learning activities

   Evaluation--Minimum of three hours per week

4. Distribute unit objectives to the students and assist them in relating these objectives to the requirements for the program

   Evaluation--Lesson and demonstration outlines will be available for review

5. Assist students to complete unit objectives by providing demonstrations of skills and concepts for each unit of instruction

   Evaluation--Continuing

6. Provide a test for each unit of instruction

   Evaluation--Copies of each test will be available for inspection

7. Conduct safety checks of each student before operation of unit equipment or use of materials

   Evaluation--Maintain progress charts that show student progress

TIME FRAME			
1	2	3	4
—			
—			
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—

METALS PROGRAM

TEACHER FACILITATING OBJECTIVES (Cont'd)

	TIME FRAME			
	1	2	3	4
8. Maintain unit-objective progress charts that show student overall progress in completing the course objectives				
Evaluation--Continuing	—	—	—	—
9. Provide time for students to meet with resource people who represent chosen areas of metals occupations				
Evaluation--Continuing	—	—	—	—
10. Visit metals facilities and businesses to establish a field trip schedule and to keep up-to-date on requirements for entry-level employment and company grooming and dress code				
Evaluation--Keep records of visits and send a summary to the Coordinator of Career Development Programs at the end of each semester		—		—
11. Develop information and materials to be used in the recruitment of intermediate through 11th grade students for the following year's classes				
Evaluation--Complete by the end of April of each school year				—
12. Enroll a maximum of 24 students per teaching hour, as indicated by the District Plan for the Metals Program, for the next year's classes				
Evaluation--Complete by end of the 14th week of the spring semester				—
13. Meet with metals associations to promote the objectives of the Metals Program and to obtain community support for career development programs in general				
Evaluation--Continuing	—	—	—	—
14. Establish a budget and determine the materials and equipment needed to provide an up-to-date program				
Evaluation--Submit budget at time set by the district calendar				—

METALS PROGRAM

TEACHER FACILITATING OBJECTIVES (Cont'd)

	TIME FRAME			
	1	2	3	4
15. Provide opportunities for students to observe the activities of individuals in a variety of metal-working jobs, and assist them to relate the experiences to personal decision making				
Evaluation--Continuing	___	___	___	___
16. Meet and confer with students to evaluate their performance				
Evaluation--Continuing	___	___	___	___
17. Submit grading reports to designated individuals in the schools				
Evaluation--Complete by end of the 9th week				
--Complete by end of the 18th week	___	___	___	___
18. Post and maintain regular office hours and resource periods that will provide for additional laboratory time, discussion, and consultation concerning individual student contracts				
Evaluation--Continuing	___	___	___	___
19. Establish and maintain a system of records consistent with the laws and appropriate to student activities				
Evaluation--Continuing	___	___	___	___
20. Attend at least four hours of inservice training during each school year				
Evaluation--Complete by end of the 36th week				___
21. Participate as a member of the Industrial Arts Advisory Committee				
Evaluation--Attend all meetings held during the school year; committee minutes will be kept on file in the Career Development Programs Office		___		___
22. As needed, consult with administrators, other teachers, and guidance personnel relative to the student and his/her career goals				
Evaluation--Continuing	___	___	___	___

METALS PROGRAM

TEACHER FACILITATING OBJECTIVES (Cont'd)

	TIME FRAME			
	1	2	3	4
23. Assist in conducting an annual follow-up study of all disadvantaged and handicapped enrollees and submit a report of the study to the Coordinator of Career Development Programs				
Evaluation--Complete for preceding semester by end of the current semester		----		----
24. Conduct a survey (100 percent of the students in the program) to evaluate the program prior to the end of each semester				
Evaluation--Complete by end of 17th week		----		
--Complete by end of 35th week				----
25. Submit a report of progress in completing the teacher facilitating objectives and student performance objectives (see appendix)				
Evaluation--Complete by end of 17th week		----		----
26. Revise and rewrite objectives for the Metals Program				
Evaluation-Complete by end of 18th week		----		----
27. Develop new instructional materials and visual aids based on revisions of the student performance objectives				
Evaluation--Complete by end of 18th week		----		----
28. Provide students with assistance in developing a resume and personal data file				
Evaluation--Ongoing	----	----	----	----
29. Assist students to do mock job search and to properly complete a job application form				
Evaluation--Ongoing	----	----	----	----

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES

Each student in the Metals Program will be awarded credits upon successful completion of the objectives listed within the following instructional units:

I. Safety

II. Metals Technology

III. Bench and Wrought Metal

IV. Sheet Metal

V. Art Metal

VI. Forging

VII. Heat Treating

VIII. Foundry

IX. Welding

X. Machine Shop

XI. Metals in Everyday Living

XII. Finishing

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit I--Safety

The student will be able to demonstrate his/her complete understanding of safety in the metal shop in the following areas:

1. Attitude, including respect for the rights of others
2. Proper dress, including eye protection and the danger of wearing jewelry
3. Care and use of hand tools
4. Handling and storage of sharp tools
5. Handling of hot metals
6. Use of acids
7. Storage of flammable materials including oily rags
8. Care and use of hand-operated electric tools
9. Care and operation of machines including the use of safety guards
10. Special problems involved in the operation of revolving machines
11. Removal of metal chips from machines
12. Lifting of heavy objects
13. Storage of materials and projects
14. Importance of a clean working area
15. Proper reporting of all injuries
16. Knowing and doing one's job properly

Evaluation--The student will respond correctly to 100 percent of the items on a safety test, or series of safety tests, and will make an on-the-spot demonstration for the instructor when appropriate.

TIME FRAME			
1	2	3	4

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit II--Metals Technology

The student will be able:

		TIME FRAME			
		1	2	3	4
1.	To name the areas of metalworking covered by the term "general metals"				
2.	To name six occupations in the field of general metals				
3.	To identify pure metals and alloys and know whether each is ferrous or nonferrous				
4.	To name the seven properties of metals				
5.	To distinguish between the United States Standard and the Brown and Sharpe (or American Standard) wire and sheet-metal gages, and will know which is used to measure ferrous metals and which to measure nonferrous				
6.	To explain why certain metals are alloyed with steel to obtain a desired characteristic				
7.	To know by its appearance whether a sample is hot- or cold-rolled steel				
8.	To identify galvanized metal and explain the purpose of its coating				
9.	To identify five common shapes of bar stock				
10.	To identify seven nonferrous metals by color				
11.	To devise step-by-step plans for making a project, to compute the cost of the necessary materials and maintain a record thereof, and to keep track of how much he/she uses				
12.	To use a common steel rule to measure within 1/32nd of an inch				
13.	To read the circumference of a metal duct by use of a circumference ruler				
14.	To identify and explain the use of three kinds of hammers				

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit II--Metals Technology

	TIME FRAME			
	1	2	3	4
15. To identify and explain the use of a center punch and a prick punch				
16. To identify and explain the use of the following metal layout tools: scriber, dividers, hermaphrodite calipers, angle plate, toolmaker's clamps and V blocks				
Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent on all items 1 through 16.				
17. To identify the following by spark test: cast iron, low-carbon steel, high-carbon steel and stainless steel				
Evaluation--The student will demonstrate on the spot for the instructor.				
18. To identify and use each of the three heads that form a part of a combination square				
Evaluation--The student will demonstrate on the spot for the instructor.				

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit III--Bench and Wrought Metal

The student will be able:

		TIME FRAME			
		1	2	3	4
1.	To identify and explain the correct use of four common types of cold chisels				
2.	To identify its parts when given a two-view picture of a twist drill				
3.	To identify the correct cutting fluids to use on common metals				
4.	To identify its parts when given a picture of a file				
5.	To identify four cuts and eight shapes of files				
6.	To identify the three kinds of threads cut into metal				
7.	To identify four types of hand-hacksaw blades by tooth arrangement and to explain the correct use of each				
	Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent on all items from 1 through 7.				
8.	To cut heavy metals with a hand hacksaw by knowing how to select and use the proper blade for a given job				
	Evaluation--The student will submit an example of his/her completed work to the instructor for approval.				
9.	To cut structural metals with a power hacksaw				
	Evaluation--The student will submit an example of his/her completed work to the instructor for approval.				
10.	To perform accurate drilling on the drill press, the portable electric hand drill and the manually operated hand drill				

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit III--Bench and Wrought Metal

	TIME FRAME			
	1	2	3	4

Evaluation--The student will submit an example of his/her completed work to the instructor for approval. ____

11. To identify three sets of twist drills, and select the correct drill for making a hole for a 1/4-20 tap

Evaluation--The student will make an on-the-spot demonstration for the instructor. ____

12. To sharpen a drill to the correct angles

Evaluation--The student will make an on-the-spot demonstration for the instructor. ____

13. To make two 90^{o} bends, two inches apart, using a vise and monkey wrench when given a six-inch length of 1/8 x 1" stock and each of the three legs must be within 1/8" of the specified measurement

Evaluation--The student will submit an example of his/her completed work to the instructor for approval. ____

14. To set up a metal-forming machine and form a piece of metal to a size and shape specified by the instructor

Evaluation--The student will submit an example of his/her completed work to the instructor for approval. ____

15. To demonstrate his/her complete understanding of safety in the setting up and use of a metal grinder

Evaluation--The student will have responded correctly to all pertinent items on a safety test (see Unit I) and will make an on-the-spot demonstration for the instructor. ____ ____

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit IV--Sheet Metal

The student will be able:

		TIME FRAME			
		1	2	3	4
1.	To identify five different seams used in sheet metal work				
2.	To name three methods of sheet metal layout				
3.	To identify six different kinds of hand snips				
4.	To identify its parts when given a picture of a squaring shears				
5.	To identify the four most commonly used sheet metal forming stakes				
6.	To identify its major parts when given a picture of a bar folder (forming machine)				
7.	To identify, from a picture of a rotary machine with the following sets of rolls: bearing rolls, crimping rolls, wiring rolls, burring rolls and turning rolls				
8.	To identify five common head shapes each of types A and B sheet metal screws				
9.	To explain the step-by-step procedure for tinning a soldering copper				
10.	To identify and explain the function of the fluxes used in soft soldering				
11.	To explain the step-by-step procedure for sweat soldering two pieces of sheet metal				
12.	To identify four different edges used in sheet metal work				

Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent on all items from 1 through 12.

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit IV--Sheet Metal

	TIME FRAME			
	1	2	3	4
13. To lay out and construct a sheet metal utility box that measures within 1/8" of the stated overall dimensions *Evaluation--The student will submit his/her completed project to the instructor for approval.*				___
14. To lay out and construct a sheet metal funnel using radial-line development *Evaluation--The student will submit his/her completed project to the instructor for approval.*		___		___
15. To demonstrate his/her complete understanding of safety in the operation of a squaring shears *Evaluation--The student will have responded correctly to all pertinent items on a safety test (see Unit I), and will make an on-the-spot demonstration for the instructor.*	___	___	___	___
16. To lay out and cut sheet metal using the squaring shears *Evaluation--The student will make an on-the-spot demonstration for the instructor.*	___	___	___	___
17. To form sheet metal over the stakes *Evaluation--The student will submit an example of his/her completed work to the instructor for approval.*		___	___	___
18. To use a bar folder to form single- and double-hem edges *Evaluation--The student will submit an example of his/her completed work to the instructor for approval.*	___	___	___	___

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit IV--Sheet Metal

	TIME FRAME			
	1	2	3	4
19. To use a cornice and/or box-and-pan break to bend sheet metal *Evaluation--The student will submit an example of his/her completed work to the instructor for approval.*				
20. To use a slip-roll machine to form sheet metal cylinders and cones *Evaluation--The student will submit an example of his/her completed work to the instructor for approval.*				
21. To use a hand groover to form locked, grooved seams *Evaluation--The student will submit an example of his/her completed work to the instructor for approval.*				
22. To use a soldering furnace, a 1 lb. soldering copper, and 50-50 solder to join two 2 x 6" pieces of galvanized sheet metal with a 3/8" lap seam *Evaluation--The student will submit an example of his/her completed work to the instructor for approval.*				

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit V--Art Metal

The student will be able:

	TIME FRAME			
	1	2	3	4
1. To identify the following surface decorations: piercing, planishing, fluting, flaring, coloring, etching, engraving, enameling, chasing, repousse and filigree			___	___
2. To explain what is meant by the terms "annealing" and pickling"		___		___
3. To identify the following methods of decorating the edge of a metal object: doming, fluting, scalloping, flaring and overlapping			___	___
4. To identify parts of a metal-spinning lathe from a picture		___	___	___
5. To identify five common spinning tools from a picture		___	___	___
Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent for all items 1 through 5.				
6. To select a design and complete a project using the tapping process for either the background or the border when given a sheet of 30-gage copper 6" square				
Evaluation--The student will submit his/her completed project to the instructor for approval				___
7. To demonstrate his/her knowledge of the use of chasing and stamping tools by completing two projects and using a different set of tools for each				
Evaluation--The student will submit his/her completed projects to the instructor for approval.				___

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit V--Art Metal

	TIME FRAME			
	1	2	3	4
8. To demonstrate his/her understanding of metal tooling when given a sheet of 32-gage copper 6" square by fashioning a molding device from a 6" length of a 5/16" wooden dowel, selecting a pattern and completing a project				
Evaluation--The student will submit his/her completed project to the instructor for approval.		___		___
9. To demonstrate his/her understanding of the sinking and beating-down processes by completing two projects, using a different process for each				
Evaluation--The student will submit his/her completed project to the instructor for approval		___		___
10. To hammer out a bowl by the raising process from a sheet of 18-gage copper 12" in diameter				
Evaluation--The student will submit his/her completed project to the instructor for approval		___		___
11. To silver solder a finding on a piece of jewelry				
Evaluation--The student will submit his/her completed project to the instructor for approval.	___	___	___	___
12. To select a form, set up his/her work and spin a simple bowl from a sheet of 18-gage copper 10" in diameter				
Evaluation--The student will submit his/her completed project to the instructor for approval.		___		___
13. To correctly use a jewelry saw after having selected the proper blade for a given job				
Evaluation--The student will make an on-the-spot demonstration for the instructor.	___	___	___	___

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit V--Art Metal

	TIME FRAME			
	1	2	3	4
14. To use a gas furnace to anneal any common art metal *Evaluation--The student will make an on-the-spot demonstration for the instructor.*				
15. To identify and explain the use of four natural compounds commonly employed for the buffing of metals *Evaluation--The student will make an on-the-spot demonstration for the instructor.*				
16. To demonstrate his/her complete understanding of safety in the mixing of various kinds of acids in water to make pickling solutions *Evaluation--The student will have responded correctly to all pertinent items on a safety test (see Unit I), and will make an on-the-spot demonstration for the instructor*				

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit VI--Forging

The student will be able:

1. To name four kinds of workers associated with forging

2. To identify parts of an anvil when given a picture

3. To identify the three most common types of hot-metal tongs

4. To identify five sets of anvil tools and set-hammer combinations

   Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent on all items 1 through 4.

5. To demonstrate his/her complete understanding of safety in the lighting and operation of a gas or oil forging furnace

   Evaluation--The student will have responded correctly to all pertinent items on a safety test (see Unit I), and will make an on-the-spot demonstration for the instructor.

6. To recognize the correct forging temperature of any given metal by its color

   Evaluation--The student will make an on-the-spot demonstration for the instructor.

7. To draw a 10" length of 1" round cold-rolled steel out to a 1/2" round rod

   Evaluation--The student will submit an example of his/her completed work to the instructor for approval.

TIME FRAME			
1	2	3	4
___	___	___	___
			___
			___
			___
___	___	___	___
			___
			___

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit VI--Forging

8. To use three 8" lengths of 1/2" square hot-rolled steel to:

   a. Transform one piece into a circle

   b. Twist the second two complete turns

   c. Upset the third on both ends to twice its original area

   Evaluation--The student will submit an example of his/her completed work to the instructor for approval.

TIME FRAME			
1	2	3	4
			—

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit VII--Heat Treating

	TIME FRAME			
	1	2	3	4
1. To name three methods for testing the hardness of metals		___		___
2. To explain his understanding of hardening, tempering, annealing and casehardening of metals				
Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent.		___		___
3. To properly heat treat the cutting edge of a cold chisel				
Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent		___		___
4. To know the temperature of a heated metal by its color				
Evaluation--The student will make an on-the-spot demonstration for the instructor.				___

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit VIII--Foundry

The student will be able:

1. To identify, from a picture, 18 common items and tools used in foundry work

   Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent.

2. To properly temper the sand used in molds

   Evaluation--The student will make an on-the-spot demonstration for the instructor. (When picked up and squeezed, a clump must retain a sharp impression of the student's fingers.)

3. To demonstrate his/her complete understanding of safety in the lighting and operation of a melting furnace

   Evaluation--The student will have responded correctly to all pertinent items on a safety test (see Unit I), and will make an on-the-spot demonstration for the instructor.

4. To select a simple pattern; make the necessary setup, with the help of another student, pour molten metal into the cavity and then finish and remove the project

   Evaluation--The student will make an on-the-spot demonstration for the instructor and will submit the completed project for approval.

TIME FRAME			
1	2	3	4
			___
		___	___
___	___	___	___
	___	___	___

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit IX--Welding

The student will be able:

	TIME FRAME			
	1	2	3	4
1. To demonstrate his/her complete understanding of safety in the setting up and lighting of an oxyacetylene welding torch				
Evaluation--The student will have responded correctly to all pertinent items on a safety test (see Unit I), and will make an on-the-spot demonstration for the instructor.	___	___	___	___
2. To know and set the correct operating pressures on both the acetylene and oxygen gages	___	___	___	___
3. To identify an alternating and a direct-current welding machine and explain when and why each is used		___		___
4. To select the electrode, welding current and welding position appropriate for a given job from the American Welding Society's chart of common mild-steel electrodes		___		___
5. To select the proper amperage for an electrode of any given size using a chart		___	___	___
6. To identify the welding symbols shown on a blueprint				___
Evaluation--The student will make an on-the-spot demonstration for the instructor and will have passed the unit test if he/she makes an overall score of at least 70 percent on all items 2 through 6.				
7. To adjust the torch to obtain oxidizing, carburizing and neutral flames				
Evaluation--The student will make an on-the-spot demonstration for the instructor.		___	___	___

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit IX--Welding

TIME FRAME

1	2	3	4

8. To use a 2 x 6" piece of 16-gage hot-rolled steel to:

   a. Run a bead without a rod
   b. Run a bead with a rod
   c. Make a butt weld
   d. Make a 1" lap weld on both sides
   e. Make a T weld

   Evaluation--The student will submit examples of his/her completed work to the instructor for approval.

9. To join together two pieces of 2 x 6" 16-gage hot-rolled steel by bronze welding

   Evaluation--The student will submit an example of his/her completed work to the instructor for approval.

10. To make a 1/2" lap seam with two 2 x 6" pieces of 20-gage galvanized sheet and then use a spot-welding machine to join them together with welds at 1" intervals

    Evaluation--The student will submit an example of his/her completed work to the instructor for approval.

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit X--Machine Shop

The student will be able:

	TIME FRAME			
	1	2	3	4
1. To identify and explain the use of the following measuring devices: outside calipers, inside calipers and micrometer				
2. To identify parts of an engine lathe from a picture				
3. To identify and explain the use of the following cutting tools: side-relief angle, end-relief angle, back rake and side rake				
4. To state the correct number of revolutions per minute for turning low-carbon steel, tool steel, cast iron, brass and aluminum.				
Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent on all items 1 through 4.				
5. To grind a roughing tool with angles suitable for turning mild steel when given a 3" length of 1/4" square stock				
Evaluation--The student will make an on-the-spot demonstration for the instructor.				
6. To locate and drill center holes with a drill press when given a 12" length of 2" round cold-rolled steel				
Evaluation--The student will make an on-the-spot demonstration for the instructor.				
7. To properly set up the work on a lathe for turning between the holes after having drilled the center holes (see Objective 6)				
Evaluation--The student will make an on-the-spot demonstration for the instructor.				
8. To face the ends, rough turn, and finish turn a 2" length of 1" round cold-rolled steel				
Evaluation--The student will make an on-the-spot demonstration for the instructor.				

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit X--Machine Shop

	TIME FRAME			
	1	2	3	4
9. To demonstrate his/her knowledge of taper turning in the following ways:				
a. By setting over the tailstock				
b. By using the compound rest				
c. By using the taper attachment				
Evaluation--The student will submit examples of his/her completed work to the instructor for approval.				———
10. To further demonstrate his knowledge of taper turning by solving problems using the following formula:				
$\text{Set over} = \frac{\text{total length in inches x taper per foot in inches}}{24}$				
Evaluation--The student will make an on-the-spot demonstration for the instructor.				———

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit XI--Metals in Everyday Living

The student will be able:

1. To draw and fill in a flow chart showing the step-by-step procedure for converting raw products into steel and including the names of four different methods for processing the pig iron

2. To name the metals that are alloyed with copper to produce brass or bronze

3. To name the ore that is used to make aluminum

Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent on all items 1 through 3.

TIME FRAME			
1	2	3	4
	___		___
___	___	___	___
___	___	___	___

METALS PROGRAM

STUDENT PERFORMANCE OBJECTIVES (Cont'd)

Unit XIII--Finishing

The student will be able:

	TIME FRAME			
	1	2	3	4
1. To demonstrate his/her understanding of the three general categories of metal finishing that follow:				
a. The addition of material to a surface, as is done in painting and electroplating	___	___	___	___
b. The removal of material from a surface, as is done in grinding and honing	___	___	___	___
c. The mechanical treatment of a surface, as is done in shot peening and sandblasting	___	___	___	___
2. To identify an oxidized metal by the color of its surface				___
3. To distinguish between rust and other forms of corrosion, and explain why some metals rust and some do not				___
4. To name at least three metal appliances used in the average home that have a porcelain enamel finish	___	___	___	___
5. To recognize an anodized aluminum surface and explain the process for anodizing		___	___	___
6. To sketch a diagram explaining the electroplating process				___

Evaluation--The student will have passed the test if he/she makes an overall score of at least 70 percent on all items 1 through 6.

METALS PROGRAM

STUDENT TERMINAL PERFORMANCE OBJECTIVES

The terminal behaviors associated with the Metals Program are those skills and behaviors that students will be able to demonstrate as a result of having completed the program. The student will:

1. Have made an appropriate career choice of a metals occupation

2. Continue in an advanced training program and/or be employed in a metals occupation

3. Be a knowledgeable consumer of metal products

4. Have developed a résumé and personal data file

5. Be able to demonstrate adequate knowledge to conduct a job search, properly complete an employment application form, and meet employer requirements for a satisfactory employment interview

6. Have developed the attitudes and interpersonal skills required for continued employment. Attitudes and interpersonal skills may be identified by observable behaviors such as:

   a. Consistent compliance with dress and grooming requirements of the work environment

   b. Ability to receive and carry out instructions

   c. Working in harmony with supervisors, fellow employees and the public served

METALS PROGRAM

EVALUATION PROCEDURE

The Metals Program will follow an information collection cycle with data being gathered at the 9th and 17th week of each semester. The teacher is responsible for gathering, preparing, and submitting evaluation reports that are based upon objectives indicated in the Metals Program Management System.

At the 9th and 17th weeks of the semester, the teacher will examine each of the objectives indicated in the management system in order to determine the degree to which each objective was accomplished. The degree of accomplishment should be indicated in the time frame space on the forms. On the narrative report, the teacher will indicate the reasons for partial or nonaccomplishment of objectives. Constraints and problems encountered should be included in the report along with suggestions for revision and/or modification of the program and the Metals Program Management System. The final report, submitted at the end of the 17th week of the semester, should be a compilation of data gathered at the 9th and 17th week.

The time line is intended to provide for program monitoring and to insure the use of evaluation data for improvement of the program. The table below indicates the time line to be followed, the forms to be used in the evaluation and where the report is to be disseminated:

Time Line	Form	Dissemination of Report
9th week	Teacher Objectives Student Objectives Narrative Report	Local school - Department Head and Principal or Designee
17th week	Teacher Objectives Student Objectives Narrative Report	Local school - Department Head District - Superintendent or Designee

The Career Development Programs Office will act as an information and data retrieval center for career development programs. After final evaluation reports on the Metals Program are received, they will be reviewed in order to ascertain the type and level of support needed for the program on the district and local school level.

The Metals Program Management System will be revised and updated on a yearly basis or as needed. Changes in the management system will be based upon student and program needs as indicated in the evaluation reports that are prepared by local teachers and other appropriate individuals.

METALS PROGRAM

APPENDIX

METALS PROGRAM

MANAGEMENT SYSTEM REPORT--TIME FRAME CHECK LIST

TEACHER FACILITATING OBJECTIVES

Teacher_____ Date_____

School_____ Date_____

Page ___ Time Frame		Page ___ Time Frame		Page ___ Time Frame		Page ___ Time Frame		Page ___ Time Frame		Page ___ Time Frame	
1	2	1	2	1	2	1	2	1	2	1	2

METALS PROGRAM

MANAGEMENT SYSTEM REPORT--TIME FRAME CHECK LIST

STUDENT OBJECTIVES

Teacher_____ Date_____

School_____ Date_____

Page	Page	Page	Page	Page	Page
Time Frame	Time Frame	Time Frame	Time Frame	Time Frame	Time Frame
1 | 2	1 | 2	1 | 2	1 | 2	1 | 2	1 | 2

METALS PROGRAM

MANAGEMENT SYSTEM REPORT

NARRATIVE REPORT

Teacher_____ Course_____

School_____ Date_____

A Narrative Report should:

- Evaluate success in completing teacher and student objectives.
- Analyze reasons for partial or noncompletion of objectives.
- Describe constraints or problems affecting the teaching or learning process.
- Suggest revisions to improve the course.
- Recommend methods for future program promotion.

NARRATIVE REPORT
(Attach additional sheets if necessary.)